

**CARPET STRETCHER, CONTROL APPARATUS FOR THE CARPET
STRETCHER, AND KNEE-PROTECTING MEMBER FOR THE CARPET
STRETCHER**

BACKGROUND OF THE INVENTION

This application claims the priority of Korean Patent Application No. 2003-10719, filed on February 20, 2003, in the Korean Intellectual Property Office, the disclosure of which is incorporated herein in its entirety by reference.

1. Field of the Invention

The present invention relates to a carpet stretcher, and more particularly, to a carpet stretcher; a control apparatus for the carpet stretcher, and a knee-protecting member for the carpet stretcher.

2. Description of the Related Art

U.S. Pat. No. 5,255,894, entitled "Electromagnetic Carpet Stretcher Device", discloses a conventional electromagnetic carpet stretcher device shown in FIG. 1A.

The electromagnetic carpet stretcher device shown in FIG. 1A includes an engaging head 22 adapted to engage a carpet C, a housing 1 connected with a rear end of the engaging head 22, an electromagnetic coil 4 arranged in the housing 1 and adapted to generate an electromagnetic field, and a plunger (10, 11, 12, 13, and 14) moveable in the housing 1 in a longitudinal direction under the action of the electromagnetic field of the electromagnetic coil 4, and adapted to strike the housing 1 so as to transmit impulse to the rear end of the engaging head 22. When the plunger (10, 11, 12, 13, and 14) strikes the housing 1, the electromagnetic carpet stretcher device advances and the carpet C engaging the engaging head 22 stretches.

FIG. 1B illustrates a stretching principle of the carpet C using the electromagnetic carpet stretcher device shown in FIG. 1A. This principle will be explained in terms of a stretching principle of a rubber band. Referring to FIG. 1B, when a front end A of a rubber band having an initial length "l" is pulled, the rubber band stretches by Δ . Similarly, the carpet C stretches by a length Δ by which the electromagnetic carpet stretcher device advances due to the strike of the plunger

head 14 to the housing 1.

However, it is difficult for the electromagnetic carpet stretcher device and the carpet C to move forward using only the conservation momentum caused by the strike of the plunger (10, 11, 12, 13, and 14) to the housing 1.

Also, the conventional electromagnetic carpet stretcher device may cause injury to the knee of a person operating it, making it necessary for the operator to wear knee protection.

SUMMARY OF THE INVENTION

The present invention provides a carpet stretcher capable of easily stretching a carpet.

The present invention also provides a control apparatus for the carpet stretcher, which can control a stretching force according to the size and type of a carpet to be stretched.

The present invention also provides a knee-protecting member to protect a knee of a worker using the carpet stretcher.

According to an aspect of the present invention, there is provided a carpet stretcher comprising: an engaging head comprised at a front end of the carpet stretcher that engages a carpet; a sliding member that is connected to a rear end of the engaging head to move the engaging head back and/or forth within a predetermined space; a housing unit that covers the sliding member; a driving unit that drives the sliding member; and a carpet fixing unit to push and fix the carpet, wherein, while the carpet is fixed by the engaging head and the carpet fixing unit, the sliding member is moved a predetermined distance by the driving unit, and the engaging head forwards a distance that is equal to the distance by which the sliding member is moved, stretching the carpet.

The driving unit may be a pneumatic driver or an electric driver.

The driving unit may include a cylinder, a piston, and a control unit controlling movement of the piston. In this case, the piston may include a first member oscillating back and forth in the cylinder, and a second member disposed outside the cylinder in connection with the first member. The first member may be connected to the second member to be movable back and/or forth in a longitudinal direction of the first member. The second member may be connected to the sliding member and moves the sliding member when the first member oscillates back and forth.

Alternatively, the piston may further comprise a third member connected to the second member, the third member pushing and impacting the sliding member when the first member moves. In this case, the carpet stretcher may further comprise an impact-buffering member on a surface of the third member opposite to the sliding member.

The control unit of the driving unit may include an air compressor, an air direction control valve, and a trigger switch.

The driving unit may further comprise an electromagnetic generating an electromagnetic field in the cylinder, and the control unit intermittently supplies power to the electromagnetic coil to control movement of the piston.

The control unit may includes a power controller that produces power of a predetermined magnitude to be supplied to the electromagnetic coil using power supplied from an external source, and a switching unit that intermittently supplies the electromagnetic coil with the produced power.

The switching unit may include: a switch that is manipulated by a user to output a signal to instruct the electric carpet stretcher to operate; and a power supply time controller that supplies the electromagnetic coil with the power produced by the power controller for a predetermined period of time in response to the signal.

The control unit may further include a power level adjuster that adjusts the magnitude of the power output from the power controller to one of two or more levels. The power level adjuster may include: a power voltage divider that divides the magnitude of the power output from the power controller into the two or more levels and then outputs the power; and a switch that is connected to an output port via which the power divided into the two or more levels is output.

The engaging head of the carpet stretcher may comprise protrusions that are used to engage the carpet. Alternatively, the engaging head may include engaging pins that engage the carpet and an engaging pin adjuster that adjusts an engaging depth of the engaging pins.

The carpet fixing unit of the carpet stretcher may include: a carpet fixing unit body having a bottom plate touching the carpet; a pivot that is installed on the bottom plate and adjacent to a rear end of the housing unit; a fixing pin moving plate that is combined with the pivot to be moveable within a predetermined angular range; a first spring that is interposed between the fixing pin moving plate and the bottom plate to elastically support the fixing pin moving plate; and fixing pins that are located

beneath an end portion of the fixing pin moving plate so as to fix the electric carpet
stretcher to the carpet via a throughhole formed in the bottom plate. In this case,
the carpet stretcher may further include a knee-protecting member that is made of a
soft material and installed on the fixing pin moving plate. Alternatively, the
5 knee-protecting member may include a concave portion that accommodates a knee
of a user who operates the fixing pin moving plate.

The carpet stretcher according to the present invention may further comprise
a second spring that provides the sliding member with a restoration force after the
sliding member is moved the predetermined distance by the driving unit.

10 The carpet stretcher may further comprise a third spring that provides a
restoration force to the third member that has moved in its longitudinal direction by
the driving unit.

The carpet stretcher may further comprise a handle that is used to move the
carpet stretcher. The carpet stretcher may further comprise a band that is installed
15 on the carpet fixing unit to move the carpet stretcher. The carpet stretcher may
further comprise a connection member connected to vary a distance between the
driving unit and the carpet fixing unit.

According to another aspect of the present invention, there is provided a
carpet stretcher comprising: a main body including an engaging head that engages a
20 carpet; a carpet fixing unit, connected to the main body, pushing and fixing the
carpet; and a connection member connected to vary a distance between the main
body and the carpet fixing unit.

An end of the connection member may be fixedly attached to the carpet fixing
unit and the other end of the connection member may be slidingly attached to the
25 main body such that the length of the carpet stretcher can be varied.

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and the other end of the connection member may be slidingly attached to the carpet
fixing unit such that the length of the carpet stretcher can be varied.

30 According to another aspect of the present invention, there is provided an
apparatus for controlling a carpet stretcher using an electromagnetic force generated
by an electromagnetic coil, the control apparatus comprising: a power controller that
produces power of a predetermined magnitude to be supplied to the electromagnetic
coil using power supplied from an external source; a power level adjuster that

adjusts the power output from the power controller to one of two or more levels; and a switching unit that intermittently supplies the electromagnetic coil with the produced power.

The power level adjuster may comprise: a power voltage divider that divides the magnitude of the power output from the power controller into the two or more levels and the outputs the power; and a switch that is connected to an output port via which the power divided into the two or more levels is output.

The switching unit may comprise: a switch that is manipulated by a user to output a signal to instruct the electric carpet stretcher to operate; and a power supply time controller that supplies the electromagnetic coil with the power produced by the power controller for a predetermined period of time in response to the signal.

According to another aspect of the present invention, there is provided a knee-protecting member for a carpet stretcher comprising a main body, which includes an engaging head engaging a carpet, and a carpet fixing unit, which is connected to the main body to push and fix the carpet, the knee-protecting member comprising a concave portion that accommodates a knee of an operator when the operator fixes the carpet fixing unit to and detaches the carpet fixing unit from the carpet.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other features and advantages of the present invention will become more apparent by describing in detail exemplary embodiments thereof with reference to the attached drawings in which:

FIG. 1A is a view schematically showing an electromagnetic carpet stretcher device of U.S. Pat. No. 5,255,894 placed on a carpet;

FIG. 1B illustrates a stretching principle of a carpet using the electromagnetic carpet stretcher device shown in FIG. 1A versus a stretching principle of a rubber band;

FIG. 2 illustrates a stretching principle of a carpet using an electric carpet stretcher according to the present invention;

FIG. 3A is a schematic perspective view of an electric carpet stretcher according to a preferred embodiment of the present invention;

FIG. 3B is a schematic rear perspective view of the electric carpet stretcher shown in FIG. 3A;

FIGS. 3C and 3D are schematic cross-sectional views of the electric carpet
stretcher shown in FIG. 3A;

FIGS. 4A and 4D are cross-sectional views of an electric carpet stretcher
including second and third springs, in accordance with another preferred
embodiment of the present invention;

FIGS. 5A and 5B are views illustrating a method of operating a carpet fixing
unit shown in FIG. 3A;

FIG. 6 is a cross-sectional view of a plunger shown in FIG. 3C;

FIG. 7 is a block diagram of a power supply shown in FIG. 3A, in accordance
with another preferred embodiment of the present invention;

FIG. 8 is a perspective view of another aspect of a throughhole shown in FIG.
3B;

FIG. 9 is a cross-sectional view of a handle installed on a first housing and a
carpet fixing unit body, according to an embodiment of the present invention;

FIG. 10 is a view of a knee-protecting member made of a soft material to
protect a worker's knee, the knee-protecting member being used in an electric carpet
stretcher according to the present invention, in accordance with an embodiment of
the present invention;

FIG. 11 shows the knee-protecting member of FIG. 10 and a band, which are
installed on a carpet fixing unit;

FIGS. 12A and 12B are cross-sectional views illustrating the internal structure
of a carpet stretcher modified from the carpet stretcher shown in FIGS. 3C and 3D;

FIG. 13 is a cross-sectional view for explaining the role of an impact-buffering
member;

FIGS. 14A and 14B are cross-sectional views for explaining the function of a
connection member that varies the length of a carpet main body; and

FIGS. 15A and 15B illustrate the operations of a driving unit of a carpet
stretcher according to an embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Hereinafter, the structures and operations of a carpet stretcher, a control
apparatus for the carpet stretcher, and a knee-protecting member for the carpet
stretcher according to the present invention will be described in detail with reference
to the attached drawings.

FIG. 2 illustrates a stretching principle of a carpet using a carpet stretcher according to the present invention. A simplified carpet stretcher according to the present invention is placed on a carpet C. Referring to FIG. 2, if a predetermined position B of the carpet C is fixed and a left end A of the carpet C is pulled, only a portion I1 stretches by Δ . When the predetermined position B of the carpet C is unfixed, the carpet C stretches to a total length $l + \Delta$.

FIG. 3A is a schematic perspective view of a carpet stretcher according to an embodiment of the present invention, FIG. 3B is a schematic rear perspective view of the carpet stretcher shown in FIG. 3A, and FIGS. 3C and 3D are schematic cross-sectional views of the carpet stretcher shown in FIG. 3A.

Referring to FIGS. 3A through 3D, a carpet stretcher according to the present invention includes an engaging head 100 used to engage a carpet C, a sliding member 160, a housing unit (110 and 120), a cylinder 130, an electromagnetic coil 170, a piston (180 in FIG. 6), a carpet fixing unit 140, and a control unit 150.

In the carpet stretcher, when the carpet fixing unit 140 fixes the carpet C, power is supplied to the electromagnetic coil 170 for a predetermined period of time to generate an electromagnetic field inside the electromagnetic coil 170. The electromagnetic field moves the piston 180 to strike and push the sliding member 160 within a predetermined space. Then the sliding member 160 slides within the predetermined space to allow the engaging head 100 connected with the sliding member 160 to engage the carpet C and then to advance a predetermined distance, thereby stretching the carpet C.

The elements shown in FIGS. 3A through 3D will be explained in more detail below.

The engaging head 100 serves to engage the carpet C. Here, the engaging head 100 includes an engaging head body 101 and protrusions 102. The protrusions 102 are formed on the bottom of the engaging head body 101. The engaging head body 101 advances, engaging the carpet C. The engaging head 100 may selectively further include engaging pins 103 to engage the carpet C and an engaging pin adjuster 104 to adjust an engaging depth of the engaging pins 103. In order to prevent the carpet C from tearing when it stretches, or to effectively stretch the carpet C, the engaging pin adjuster 104 rotates clockwise or counterclockwise to adjust the engaging length of the engaging pins 103 coming out of the engaging head body 101 in consideration of the thickness and weight of the carpet C. The

engaging head 100 is combined with the sliding member 160 via a rear end 105 of the engaging head 100.

The sliding member 160 is connected with the rear end 105 to move the engaging head 100 back and/or forth.

5 The housing unit 110, 120 covers the sliding member 160. The housing unit is divided into a first housing 110, and a second housing 120. The first housing 110 covers the sliding member 160 to guide the movement of the sliding member 160. The second housing 120 is coupled to a rear end of the first housing 110, covers a third member 181 and a portion of the sliding member 160, and guides the
10 movement of the third member 181. The cylinder 130 is connected with a rear end of the second housing 120, covers the electromagnetic coil 170, and covers second and first members 182 and 183 of the piston 180 at an initial position of the piston 180.

FIGS. 4A and 4B are cross-sectional views for explaining the internal
15 structure and operation of a carpet stretcher having second and third springs, according to another embodiment of the present invention. FIG. 4A shows an initial state of the carpet stretcher, and FIG. 4B shows an operational state of the carpet stretcher.

The sliding member 160, which has slid the predetermined distance, can
20 return to its initial position by a second spring 114 in the first housing 110. The second spring 114 is installed in the first housing 110 to enclose the sliding member 160. An end of the second spring 114 located toward the engaging head 100 pushes against the interior of the first housing 110 and the other end thereof is fixed by a second spring fixing portion 161 of the sliding member 160.

25 FIGS. 5A and 5B are views for explaining the operations of the sliding member 160, the piston 180, the second spring 114, and a third spring 112. When an electromagnetic field is generated inside the electromagnetic coil 170, the piston 180 experiences a force so that the third member 181 pushes the sliding member 160 into the first housing 110. Here, the second and third springs 114 and 122 are
30 compressed. When the electromagnetic field of the electromagnetic coil 170 disappears, the sliding member 160 and the piston 180 return to their initial positions due to restoration forces of the second and third springs 114 and 122.

The piston 180 moves in a longitudinal direction due to the electromagnetic field generated in the electromagnetic coil 170, to apply impulse and steady force to

the sliding member 160. The piston 180 may include the third member 181, the second member 182, and the first member 183. The third head 181 directly touches the sliding member 160 when the piston 180 moves. The second member 182 is fixed to the central portion of the third member 181 and extends in a longitudinal direction of the third member 181. The first member 183 is combined with the second member 182 and moves in a longitudinal direction due to the electromagnetic field.

FIG. 6 illustrates a method of adjusting a stroke of the third member 181 by adjusting the first member 183 of the piston 180. A maximum space in which the piston 180 can move is determined by lengths d1 and d2 of a portion of the second member 182 exposed between the third member 181 and the first member 183. Here, the first member 183 may be connected with the second member 182 so as to move back and/or forth and adjust the stroke of the third member 181 by adjusting the length d1 or d2. Here, the connection between the second and first members 182 and 183 is equivalent to, for example, the connection between a bolt and a nut.

FIGS. 5A and 5B illustrate the structure and operation of the carpet fixing unit 140. The carpet fixing unit 140 serves to fix the carpet C as described with reference to FIG. 2.

The carpet fixing unit 140 includes a carpet fixing unit body 141, a pivot 142, a fixing pin moving plate 143, carpet fixing pins 145, and a first spring 146.

The carpet fixing unit body 141 has a side plate connected with the housing unit, particularly the cylinder 130, and a bottom plate contacting the carpet C. The pivot 142 is installed so that a shaft (not shown) is combined with the bottom plate of the carpet fixing unit body 141. The fixing pin moving plate 143 is connected to the pivot 142 to be moveable within a predetermined angular range. The carpet fixing unit 140 may further include the knee-protecting member 144 made of a soft material to protect a knee of a user who pushes the fixing pin moving plate 143. The carpet fixing unit 140 selectively further includes a band 148 to unfix and move the carpet fixing unit 140 after the carpet C is stretched. The user places his or her knee on the fixing pin moving plate 143 or the knee-protecting member 144 and then puts his or her calf into the band 148 to use the electric carpet stretcher according to the present invention. A throughhole 147 is formed in the bottom plate of the carpet fixing unit body 141 so that the fixing pins 145 fix the carpet C. The throughhole 147 may have various shapes as shown in FIG. 3B or 8. Two annular throughholes

147 are shown in FIG. 3B, while one rectangular throughhole 147 is shown in FIG. 8.

FIG. 7 is a block diagram of the control unit 150 shown in FIG. 3A. Referring to FIG. 7, the control unit 150 supplies power to the electromagnetic coil 170. The control unit 150 may include a power controller 151 and a switching unit 152. The control unit 150 produces a direct current (DC) having a predetermined magnitude from an alternating current (AC) IN input from an external source, to supply the electromagnetic coil 170 with the produced DC current. For this, the power controller 151 may include a transformer circuit (not shown), a rectifier circuit (not shown), and a smoother circuit (not shown), and may further include an additional circuit and an amplifier circuit to stabilize power. The switching unit 152 supplies the electromagnetic coil 170 with the power having the predetermined magnitude output from the power controller 151 or blocks the power from being provided to the electromagnetic coil 170. The switching unit 152 may include a switch 153 and a power supply time controller 154. The user manipulates the switch 153 so as to output a signal to instruct the carpet stretcher according to the present invention to operate. In response to the signal output from the switch 153, the power supply time controller 154 supplies the electromagnetic coil 170 with the power produced by the power controller 151 for a predetermined period of time.

Optionally, the control unit 150 may further include a power level adjuster 155 which adjusts the magnitude of the power output from the power controller 151 at two or more levels so as to supply the electromagnetic coil 170 connected to an output port OUT with the power. Here, the power level adjuster 155 may include a power voltage divider 156 and a selector 157. The power voltage divider 156 divides the magnitude of the power output from the power controller 151 into two or more level voltages and then outputs the voltages. The selector 157 is manipulated by the user so as to select only one of the voltages divided by the power voltage divider 156.

As shown in FIG. 3A, the carpet stretcher according to the present invention may further include a handle 190. The shape and size of the handle 190, as shown in FIG. 9, may be modified into various other forms. FIG. 9 illustrates the handle 190 installed on the first housing 110 and the carpet fixing unit body 141.

FIG. 10 illustrates the knee-protecting member 144 used in the carpet stretcher according to the present invention. Referring to FIG. 10, the knee-protecting member 144 has a concave portion formed to accommodate the

knee of a user who operates the fixing pin moving plate 143. The concave portion may be transformed into various shapes in order to protect the user's knee.

FIG. 11 illustrates the knee-protecting member 144 shown in FIG. 10 and the band 147 installed on the carpet fixing unit 140. The user places his or her knee on the knee-protecting member 144 and puts his or her calf into the band 148 to work with the carpet stretcher.

FIGS. 12A and 12B are sectional views illustrating the internal structures of carpet stretchers modified from the carpet stretchers shown in FIGS. 3C and 3D, respectively, according to embodiments of the present invention.

Unlike the embodiment illustrated in FIG. 3, the piston 180 in FIG. 12A does not include the third member 181. In other word, the second member 182 is directly connected with the sliding member 160. The sliding member 160 moves in the same direction as the first member 181 a distance equal to a distance by which the first member 181 moves. FIG. 12A illustrates the internal structure of the carpet stretcher when the first member 181 is in an initial position, and FIG. 12B illustrates the internal structure of the carpet stretcher when the sliding member 160 is moved to the left a distance that is equal to a distance by which the first member 181 is moved to the left .

FIG. 13 is a cross-sectional view for explaining the function of the impact-buffering member 184. The impact-buffering member 184 is formed on a surface of the third member 181 opposite to the sliding member 160 using a material, such as urethane. The impact-buffering member 184 absorbs noise and impacts when the third member 181 moves in a direction indicated by the arrow and hits the sliding member 160.

FIGS. 14A and 14B are cross-sectional views of a carpet stretcher according to the present invention for explaining that the length of the carpet stretcher body can be varied using the connection member 200. Referring to FIGS. 14A and 14B, the connection member 200 is fixed to the carpet fixing unit body 141. The connection member 200 is movable to the left and right under a support member 131 of the cylinder 130, so that the distance between an edge of the cylinder 130 and the carpet fixing unit body 141 is varied in a range of d_3 or d_4 . The connection member 200 is fixed to the support member 131 of the cylinder 130 by a predetermined coupling element 202.

Although not illustrated in FIGS. 14A and 14B, the connection member 200 may be fixed to the support member 131 of the cylinder 130 and connected to a bottom plate of the carpet fixing unit body 141 by a predetermined coupling element.

FIGS. 15A and 15B illustrate an example of a driving unit of a carpet stretcher according to the present invention. The driving unit includes an air compressor 191,
5 an air direction control valve 190, and a trigger switch 150a. The driving unit is a 3-port, pneumatic driver.

When a trigger switch 150a is in a position illustrated in FIG. 15A, the compressed air come out from the air compressor 191 does not pass through the
10 trigger switch 150a. And the air direction control valve 190 is moved to the right in FIG. 15A, and the compressed air come out from the air compressor 191 is injected to a left air inlet of a cylinder 130a. As a result, air pressure inside the cylinder 130a forces the first member 183a of the piston to the right.

When the trigger switch 150a is at a position illustrated in FIG. 15B, the
15 compressed air come out from the air compressor 191 passes through the trigger switch 150a. And the air direction control valve 190 is moved to the left, and the compressed air come out from the air compressor 191 is injected to the right air inlet of the cylinder 130a. As a result, air pressure inside the cylinder 130a forces the first member 183a of the piston to the left.

Although a driving unit for a carpet stretcher according to the present
20 invention is described with reference to the pneumatic, 3-port, double-acting cylinder illustrated in FIGS. 15A and 15B, a widely known 2-port or 5-port, single-acting cylinder may be used as the driving unit for the carpet stretcher according to the present invention without limitations.

As described above, a carpet stretcher, a control apparatus for the carpet
25 stretcher, and a knee-projecting member for the carpet stretcher according to the present invention provide the following effects.

First, since a carpet is stretched a distance corresponding to a distance by which the sliding member is moved while both ends of the carpet stretcher are fixed,
30 it is more practically easy to stretch the carpet.

Second, it is convenient to adjust a stretching force according to the size and type of a carpet to be stretched.

Third, a length of the carpet stretcher body can be adjusted, enabling an operator to work more conveniently with the carpet stretcher considering the type of a carpet to be stretched.

Fourth, a knee-protecting member of the carpet stretcher, which is made of a soft material, protects an operator's knee from injury when the operator works with the carpet stretcher.

While the present invention has been particularly shown and described with reference to exemplary embodiments thereof, it will be understood by those of ordinary skill in the art that the invention is not to be limited to the particular forms or methods disclosed, but to the contrary, the invention is to cover all modifications, equivalents and alternatives falling within the spirit and scope of the appended claims.